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ABSTRACT

This paper, one of three related documents, explains a model for school finance in Michigan. First, it analyzes where school districts get their money and how they spend it. Next, it details a financial model that identifies the factors related to staff adequacy levels, estimates the strength of those factors, offers ideas for the components of a policy regarding school funding, and estimates the impact of a possible policy alternative. The paper concludes that the model can be improved in three areas. Salary data can be refined and brought up to date. More factors contributing to staff adequacy levels can be identified. Finally, the model can be observed over time to see if it consistently predicts school district behavior. (Author/LD)

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Attachment B

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SCHOOL FINANCE PROJECT

Working Paper #3

MODEL OF SCHOOL FINANCE

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A MODEL OF SCHOOL FINANCE

School districts have basically two problems when dealing with school finance: how to get revenues, and how to spend them.

By better understanding the relationship between how school districts raise and spend revenue, it is perhaps possible to predict how a school district would behave if there were a change in the amount or source of school district funds. For example, what would happen if school district expenditures were increased across-the-board by 20% -- how much would go to improve staffing ratios, and how much would go for other purposes.

Having an understanding of the school district behavior is key when dealing with the concepts of equity, equality, and excellence. Equity has been defined as being a neutral relationship between a school district's resources--either financial resources or staff adequacy--and a district's wealth, property or perhaps income wealth. An understanding of school districts' behavior would permit an estimate of the impact on equity, if there were changes in the school funding structure. For example, do wealthy school districts (high SEV districts) tend to have more favorable staffing ratios than poorer school districts? What would happen if an adjustment were made to the state formula, which would give school districts having higher salary costs more money? How would this affect the relationship between staff adequacy and measures of wealth?

A second concept by which to judge possible changes in school district behavior is the notion of equality. Equality is succinctly defined as the limited variation in the distribution of resources, either financial or educational (staff adequacy). Once again, knowing the relationship between how school districts receive and spend their money could shed light on predicting what influence a change in funding would have on the distribution of financial or

educational resources. To put it another way, if there were a change in the funding mechanism, what would be the estimated change in the distribution of resources?

A third concept concerning school finance is excellence -- a minimum level of resources, financial or educational, with school districts encouraged to go beyond the minimum level. If there were some common characteristics among those districts that were below what was judged to be a minimum level, then adjustments could be made to the funding mechanism to bring those districts up to the desired level. In other words, what changes would have to be made in how school districts receive and spend their money in order to bring them up to a minimum level without limiting their ability to go above the minimums. (It would also be important that the capability to go beyond the minimums be available to all districts as a matter of equity.)

How Do Districts Spend Their Money?

School districts spend their money in a number of ways:

- they can hire more instructional staff
- they can pay higher salaries
- they can hire more noninstructional staff
- they can hire more nonprofessional staff
- they can initiate special categorical programs
- they can spend it on utilities or noninstructional items

The choice of where to spend appears to be a trade-off or a zero sum decision. This means that one decision--say to increase salaries--will have an influence on another -- how many staff to hire. It is through the budget and collective bargaining process that these decisions are made. Of course, if the total amount to spend increases substantially, the pressures of how to spend the money still exist; but are greatly reduced. What would happen if there were a substantial increase or decrease in total revenue? How, based on past experience, would school districts spend the increase or absorb the decrease.

The relationship between the amount the school district has to spend and how the district can spend their money is depicted in Figure 1.

Figure 1

HOW DISTRICTS SPEND MONEY

Amount to Spend	Staff Adequacy	Salaries	Other Staff	Expenditure Patterns
(1) Membership Aid	(1) Instructional Staff	(1) Level	(1) Noninstructional	(1) Basic
(2) Local Revenue	(2) Instructional Support Staff	(2) Benefits	(2) Categorical	(2) Added Cost
(3) State Categorical				(3) Other Instructional
(4) Federal Categorical				(4) Instructional Support
				(5) Noninstructional

Figure 2

WHERE/WHY DO DISTRICTS GET MONEY

Amount to Spend	Revenue Source	District Characteristics	History
	(1) State Equalized Aid	(1) Size	(1) General Aid
	(2) State Categorical Aid	(2) Change in Enrollments	(2) Previous Staff Adequacy
	(3) Federal Aid	(3) Urbanity	
	(4) SEV & Millage	(4) Average Family Income	
		(5) Minority	
		(6) Student Achievement	

Where/Why Do School Districts Get Their Money?

It is relatively easy to list the places where school districts get their money -- through local property tax and millage rates, through state aid, and through state and federal categorical programs. The answer to the question of why they get the money is far more complicated. Why some school districts have higher millages than others is something we still know little about. There seems to be two possible explanations (even though they might be closely related).

One possible explanation deals with the characteristics of the community -- which may influence the choice the district makes. Those characteristics are:

- Size of the school district
- Change of enrollments
- Percent minority in the community
- Urban density
- Average family income
- How well their students are doing in school

Another factor that may influence how much revenue a school district has is what they have had in the past. It is a natural law of organizations that they resist cutting back. So, if expenditures in the past were high, they will likely continue to be high. The same can be said for salaries and for staffing ratios.

The relationship between how much a school has to spend, where they get the revenues, and why they get the revenues is depicted in Figure 2.

Figure 3

GENERAL
MODEL TO PREDICT STAFF ADEQUACY

Staff Adequacy	=	Amount to Spend	+	Endogenous Variables	+	Exogenous Variables
				(1) Salaries		(1) Revenue Sources
				(2) Other Staff		(2) District Characteristics
				(3) Expenditure Pattern		(3) History

Figure 4

SPECIFIC MODEL TO PREDICT STAFF ADEQUACY

$$\text{Staff Adequacy} = (a)\ \text{Membership Aid} - (b)\ \text{Salary Level} - (c)\ \text{Benefits} + (d)\ \frac{\text{Non Professional}}{\text{Professional Staff}} - (e)\ \frac{\text{Non Instructional}}{\text{Total Staff}} + (f)\ \%\ \text{Federal} + (g)\ \%\ \text{State Categorical} + (h)\ \text{Local Control} + \text{error}$$

What Do We Want to Know?

The key question in such an analysis is to determine what is it that should be known or what is it that you want to happen. Do we want to know what determines how much a school district spends, or what kind of educational program a school provides? For the purpose of this analysis, we will be looking at what kind of educational services the school district provides. This is basically for two reasons. First, if there is a cost of doing business which varies among districts, it would be lost if looking at school district expenditures. It would be included, however, if we were looking at educational programs. Secondly, and perhaps more importantly, we think the purpose of providing funds to a school is to provide educational programs and, because this is related to the intended purpose, we think it is the better measure.

To build the model of school finance, we merely set up an algebraic equation showing what we want to be able to predict--in this case a measure of staff adequacy--and equate that to the factors which may contribute to that measure. In the previous section, we have assumed that staff adequacy is related to the amount of revenue that a school district has, plus the endogenous variables (the factors over which the school district has some control - Figure 1) and the exogenous variables (those factors over which the school district does not have control - Figure 2).

A general model, therefore, to explain why some school districts have favorable measures of staff adequacy (the number of instructional and instructional support staff per 1,000 students) is depicted in Figure 3.

Estimating the Model

Up to now, we have identified the factors influencing how a school district spends its money to get a desired level of instructional services--staff adequacy. But we do not know the strength any single factor, or any group of factors have in determining the level of staff adequacy.

While common sense tells us that the amount spent is important, it is equally logical that the amount spent for salaries is also critical. How do we determine their relative strength? The statistical technique used to estimate the influence of each of these factors is known as multiple regression. By using data on school districts which represent their behavior on these factors, an estimate is made which best predicts their relative influence.

As it turned out, some of the factors identified in the general model (Figure 3) had very little or no influence when actual data was applied to the model. Therefore, for the specific model, only those factors having a strong influence were included.

It is impossible, in social science research, to exactly explain or predict why something--in this case, staff adequacy--takes place. First, these are inevitable errors in measurement; and, second, there are probably factors which we have either not identified or measured. Ideally, the measurement errors will be kept to a minimum. As for the factors not identified, it is conceivable that decisions unique to each local district are present. Although not identified directly, an indirect measure of the "local control" factor is assumed to be included (the residual from the previous year equation).

Taking into consideration only those factors making a major contribution to staff adequacy levels and the "local control" factor, the specific model is depicted in Figure 4.

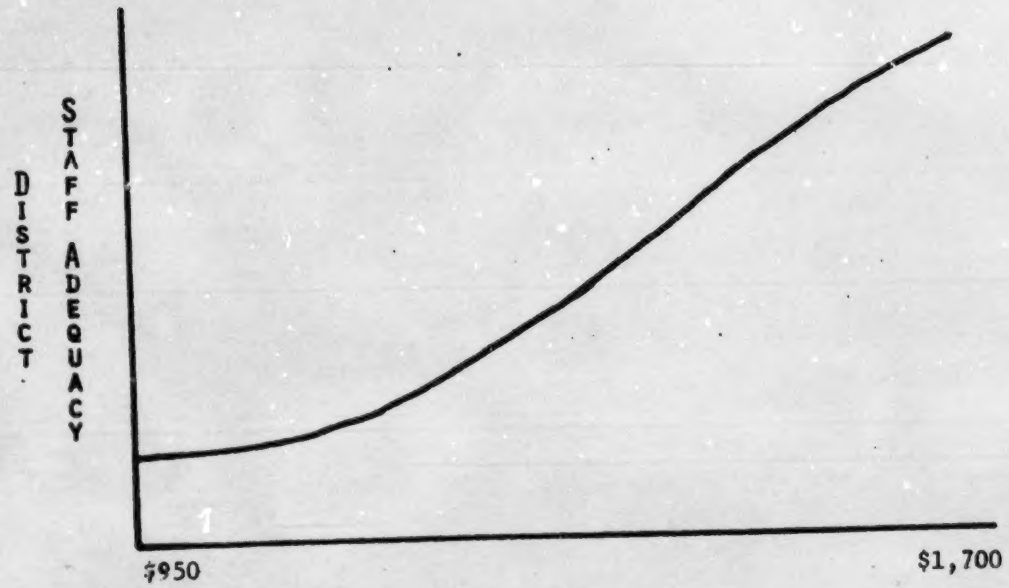
The letter in parenthesis (a) represents the strength of the factor's influences on the outcome of staff adequacy. As it turns out, membership aid (a), salary levels (b), benefit levels (c), and the ratio of nonprofessional to professionals (d), have a strong influence on staff adequacy. (For those familiar with regression analysis, the numerical estimates of these factors are given in the appendix.)

The mathematical sign is also important in the analysis, for it indicates whether an increase of the factors would add to the staff adequacy level or whether it would subtract. Based on Michigan data, greater membership aid, a higher ratio of nonprofessionals, and greater amounts of state categorical and Federal aid would add to the staff adequacy level. On the other hand, higher salaries, higher benefit levels, and more noninstructional staff would subtract from the staff adequacy level. These signs are consistent with common sense.

Another important consideration is a measure of "how good is the predictor." This is commonly measured by the Term R^2. An R^2 of .0 would indicate no ability to predict while an R^2 of 1.0 would indicate a perfect ability to predict. For the specific model applied to Michigan data, the R^2 is .72; that is, we can explain 72% of the variance of staff adequacy levels among Michigan districts. The remainder, 28%, is attributed to factors not identified or errors in measurement or data.

An interpretation of the model can be made visually. To do this, we can graph what would happen if one factor--say membership aid--were to change <u>while all others were held constant</u>.

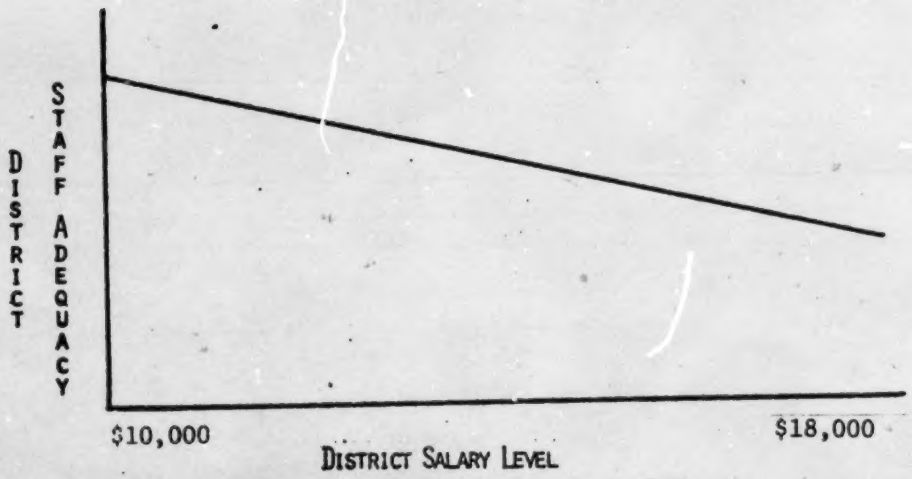
For example, the following graph shows what would happen if a district's membership aid were increased from $950 per pupil to $1,700 per pupil, while all other factors were held constant at the average.



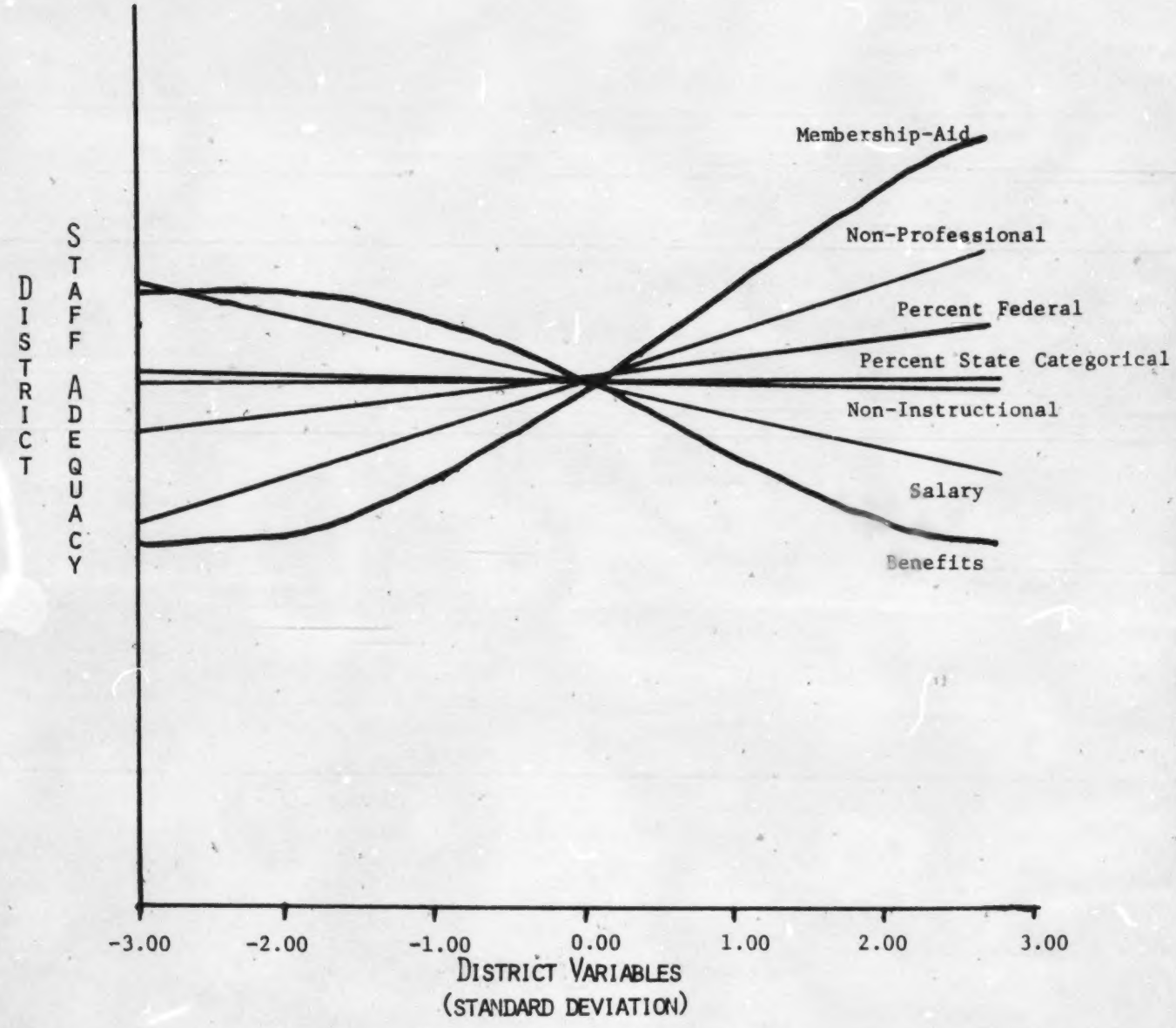
Likewise, the following graph shows what would happen if a district's average salary level were increased from $10,000 to $18,100, holding the other factors constant at the average.

The Effect of Salary Levels on Staff Adequacy

Holding All Other Variables Constant



The following graph shows all the factors at the same time, but it must be emphasized that the individual lines show what would happen to staffing levels if the individual factors were changed and the others were held constant at the average.



Interpretation and Application of the Model

It is important not to let an analysis of this type become esoteric, it must have application to be useful. To that end, we now look at an interpretation and application of the model.

From a review of the factors, their relative strength, and their direction (sign), it is clear that there is a complex combination of factors influencing staff adequacy levels. It would be simplistic to conclude, either from common sense or the model, that merely changing one factor--say membership aid --without considering the other factors, would have a major impact on staff adequacy.

Conclusion 1: Any policy directed toward (a) reducing the relationship between staff adequacy and wealth (equity), (b) narrowing the distribution of staff adequacy (equality), or (c) raising the level of staff adequacy (excellence) must deal with many factors, not just one.

The factors of membership aid, salary levels, benefit levels, and ratio of nonprofessionals are the most influential factors in determining staff adequacy. If a policy were designed to effect a change in staff adequacy levels, then such a policy would have to include these factors, at a minimum, to be effective, and they all would have to be considered at the same time. A policy directed at changing one factor would have little effect on changing staff adequacy levels.

Conclusion 2: Membership aid, salary levels, benefit levels, and the ratio of nonprofessionals are the most influential factors in determining staff adequacy levels.

As pointed out earlier, the factors in the model account for about three-quarters of the variance of staff adequacy levels. The rest--about one-quarter--is either unknown or due to errors in measurement. While the predictability is relatively high for a Social Science model, it would not produce precise results even if an ideal policy could be implemented.

Conclusion 3: A change in policy dealing with the economic factors (e.g., membership aid, salary levels, benefit levels) would not bring about a precise change in staff adequacy levels.

Conclusion 4: If precise levels of staff adequacy were judged important, decisions that are now made locally would have to be made at the state level.

The model lends itself well to applications such as simulation. Although not perfect, it can provide insight regarding such questions as: What would happen to staff adequacy levels if all school districts had the same membership aid per pupil?

In pursuing the question of equality--the equal distribution of staff adequacy among districts--we have posed the following questions:

(1) What would happen to the distribution of staff adequacy levels among school districts if either membership aid, salary levels, or benefit levels were raised to a high level (about the 80th percentile)? What would be the estimated cost? What would be the new staffing levels?

(2) What would happen to the distribution of staff adequacy levels among school districts if all the factors--membership aid, salary levels, and benefit levels--were raised to the same level? What would be the new levels? What would it cost?

By substituting actual school district data into the model, we get a base from which other comparisons can be made. The data is included in Table II. It shows that the mean, or average, district staffing ratio in the state would be 54.08 staff per 1,000 students with a standard deviation, or spread, of 5.34 staff per 1,000 students. By plugging proposed values for membership aid, salary levels, benefit levels, or all of these at the same time, a comparison can be made of the estimated impact of these possible policy alternatives.

When membership aid was set at $1,535, there was a substantial increase in the estimated staffing ratio (up nearly 8 per 1,000 students), but the equality--the distribution of staff adequacy--also increased, indicating a system that would have less equality. The estimated cost of this alternative is $440 million.

When salary levels were set at $16,140, there was a substantial decrease in the estimated staffing ratio (down over 3 per 1,000 students), and virtually no change in the distribution of staffing levels -- the measure of equality. The estimated cost of this alternative is $220 million. But with no increase in membership aid, this amount would have to be absorbed by the district, hence the reduction in the number of staff hired.

When benefit levels were set at $3,288, there was a substantial decrease in the estimated staffing ratios (down about 5.5 per 1,000 students), and the distribution--the measure of equality--was reduced less than 1 per 1,000 students (about 14%). The estimated cost was $85 million, but would have to be absorbed by the district if there were no increase in membership aid.

What would happen if the minimum membership aid were raised to $1,535, the minimum salary level to $16,140, and the minimum benefit level to $3,288 at the same time? First, the average staffing level would be reduced slightly (down about .8 per 1,000 students), and the distribution--the equality measure--

would be narrowed considerably (about 1.61 per 1,000 students or 30%). The cost would be $440 million, the increase in membership aid.

As was pointed out previously, a policy to reduce the distribution of staffing levels among districts will have to include several factors at the same time, in this illustration membership aid, salary levels, and benefit levels. Even so, the reduction in staffing levels would be only about 30%, leaving a substantial variation left to other factors. To reduce the distribution more, other controls would be necessary.

Although not the major topic of this paper, mention should be made about the steps that would be required to bring membership aid, salary levels, and benefit levels up to a minimum level. It is impossible, we believe, to bring membership up to a minimum level of $1,535 per pupil without having a minimum tax rate set state-wide. This would require a Constitutional amendment. Setting minimum levels for salary and benefit levels could be set by statute, but would have a major impact on the collective bargaining process. Most likely, it would lead to a state-wide salary and benefit schedule.

Future of the Model

What is presented in this paper is the "first cut" of a model of school finance in Michigan. It has already been of value by identifying the factors related to staff adequacy levels, estimating the strength of the factors, giving some ideas of the components of a policy regarding school funding, and estimating the impact of a possible policy alternative.

However, the model can be improved, basically in three areas. First, some data, especially salary data, can be refined and brought up-to-date. Secondly, it is possible by further analysis to identify other factors contributing to staff adequacy levels. Third, it is possible to look at the model over time to see if it consistently predicts school district behavior. (Of course, it would only be of value if it were consistent.)

Finally, the model can be expanded to explain, or predict, other relationships. For example, what would happen if membership aid or the funding formula were changed? What impact would that have on salaries, benefits, and the other factors first, then what impact would it have on staff adequacy levels. Such a "System Model"--really a system of equations--would allow one to look at a wide range of questions regarding school finance in addition to those related to staff adequacy levels.

Table I

Regression Analysis
Summary Table

Step	Variable	Standardized Coefficient	R^2 Change	Simple R	Overall
1	Membership Aid	-3.3776		.21	
	(Membership Aid)^2	8.5818		.22	
	(Membership Aid)^3	-4.4717	.052	.22	474.4
2	Salary Level	- .3207	.128	-.09	1428.4
3	Benefit Level	.8778		-.31	
	(Benefit Level)^2	-2.7137		-.31	
	(Benefit Level)^3	1.4746	.237	-.33	2663.7
4	% Federal Aid	.1353	.096	.18	
	% Non Instructional	- .0334	.005	-.10	
	% Non Professional	.4712	.138	.55	
	% State Categorical	- .0489	.001	-.04	4522.9
5	"Local Control" *	- .2487	.061	-.27	5499.9
		Total R^2	.717		

*Residual from previous year equation.

Table II

Estimated Impact of Various Policy Changes
on Staff Adequacy Levels
(Staff per 1,000 pupils)

	STAFF ADEQUACY				COST
	Mean	Change in Mean	Standard Deviation	Change in Standard Deviation	
Model	54.08	N/A	5.34	N/A	N/A
Membership Aid to 80 Percentile	61.99	+7.91	6.29	+ .95	$440,000,000
Salary Levels to 80 Percentile	50.89	-3.19	5.29	- .05	$220,000,000
Benefits Levels to 80 Percentile	48.61	-5.47	4.61	- .73	$ 85,000,000
Membership Aid, Salary Levels, and Benefit Levels to 80 Percentile	53.29	- .79	3.73	-1.61	$440,000,000